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(54) Rotary head drum assembly

(57) A rotary head drum assembly, e.g. for a VTR or DATR, comprises an upper rotary drum carrying a transducer 5, a lower fixed drum 2, a drum motor 3, and a shaft 4. A balancer 15 for automatically balancing the upper rotary drum 1 is provided, which preferably consists of a hollow ring containing liquid and/or spheres. The balancer can correct an unbalanced rotation of the upper drum, and so jitter in the input/output signal can be prevented.

FIG.5

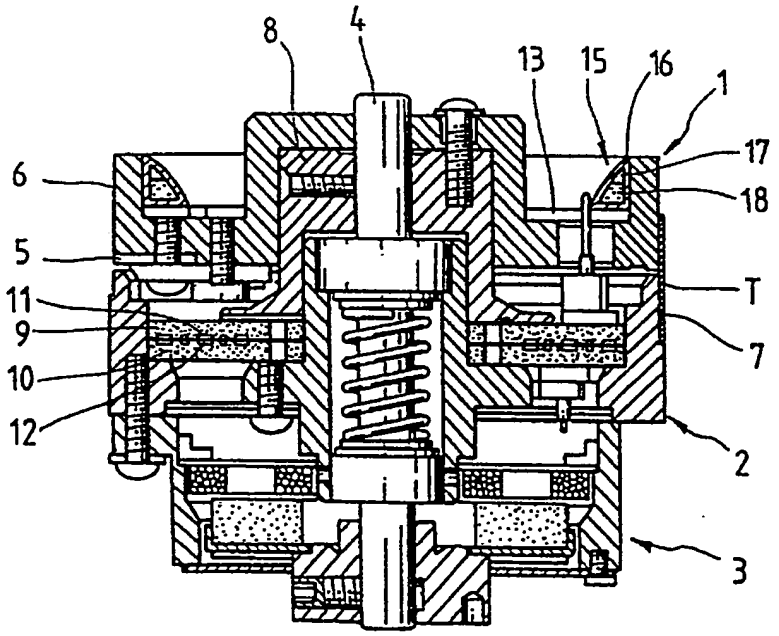

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FIG.1
(PRIOR ART)

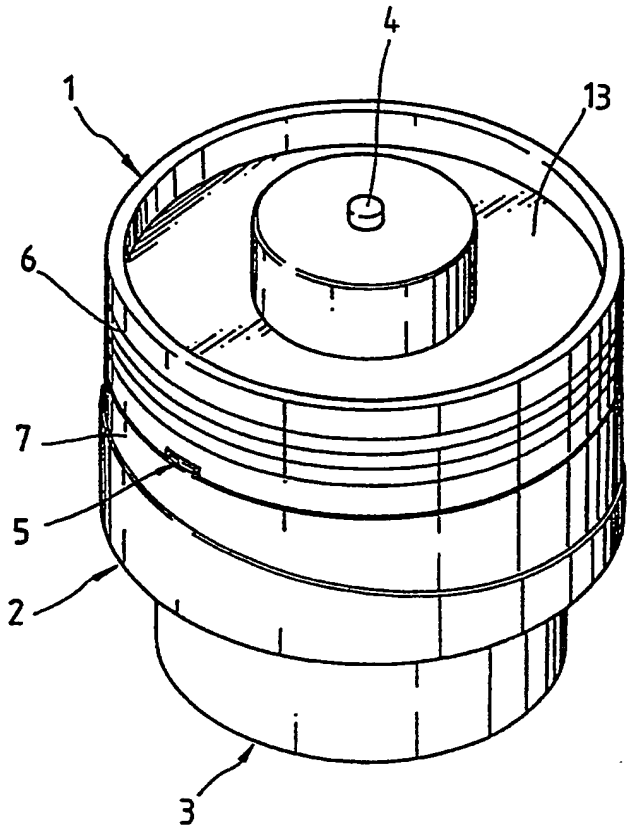


FIG.2
(PRIOR ART)

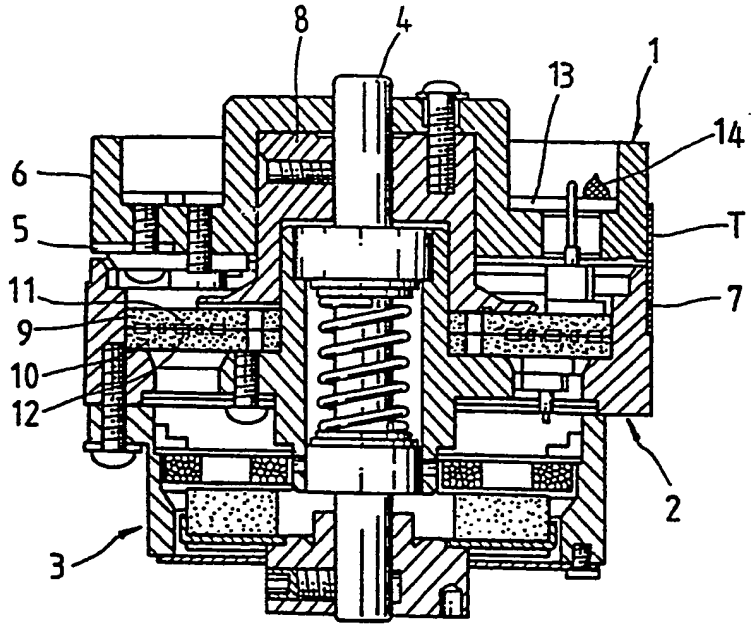


FIG.3
(PRIOR ART)

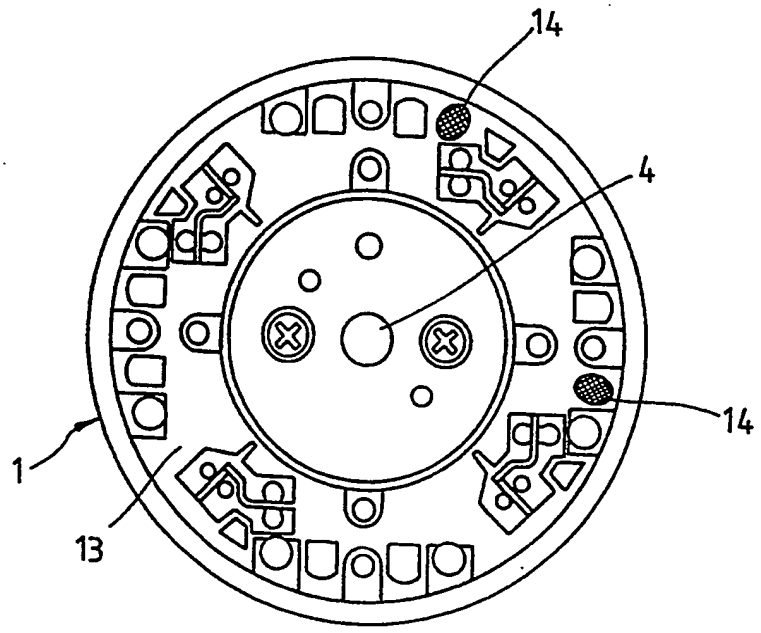


FIG.4

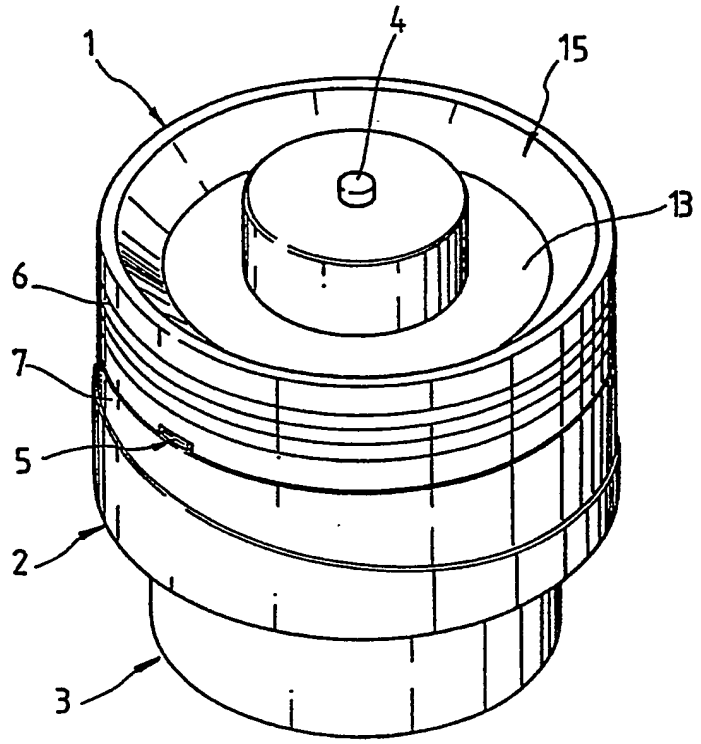


FIG.5

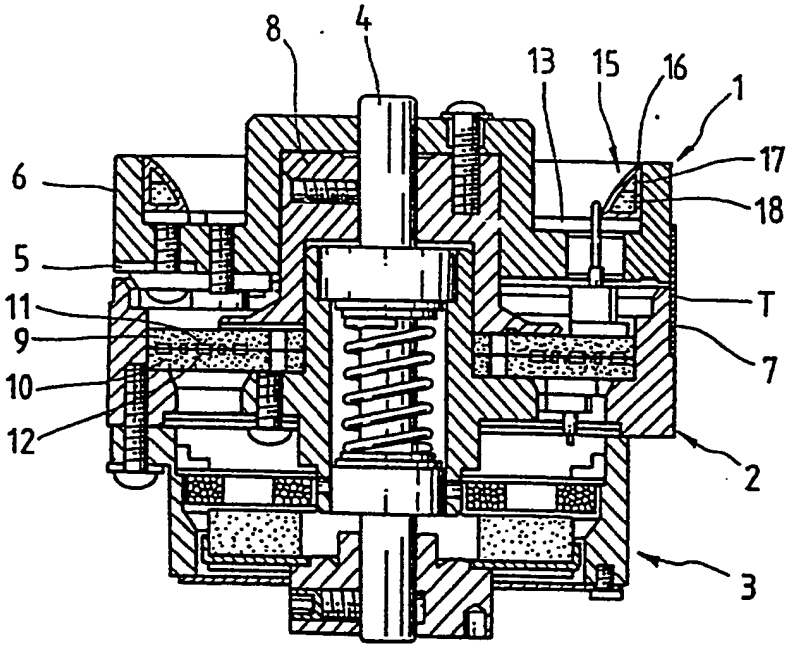


FIG.6

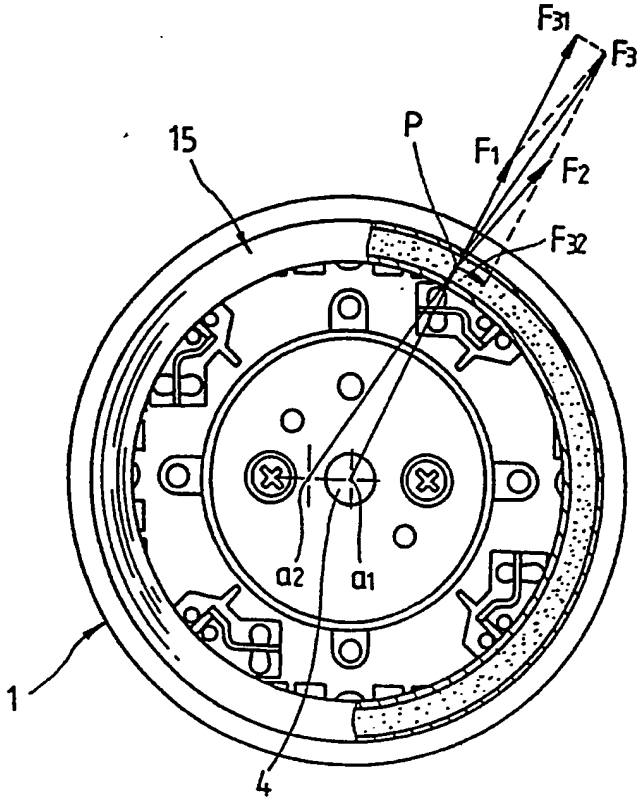


FIG.7A

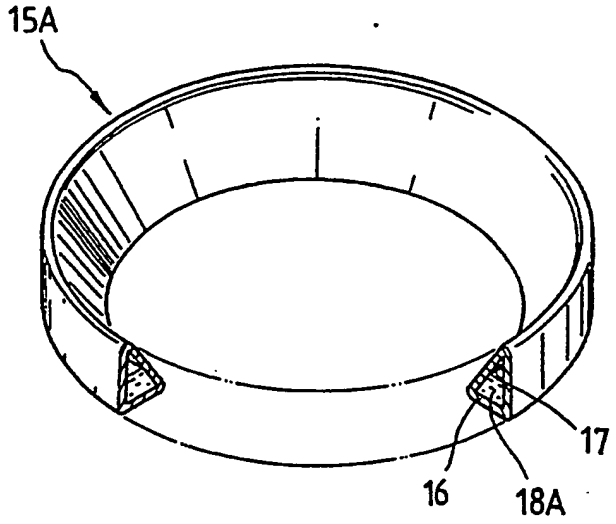


FIG.7B

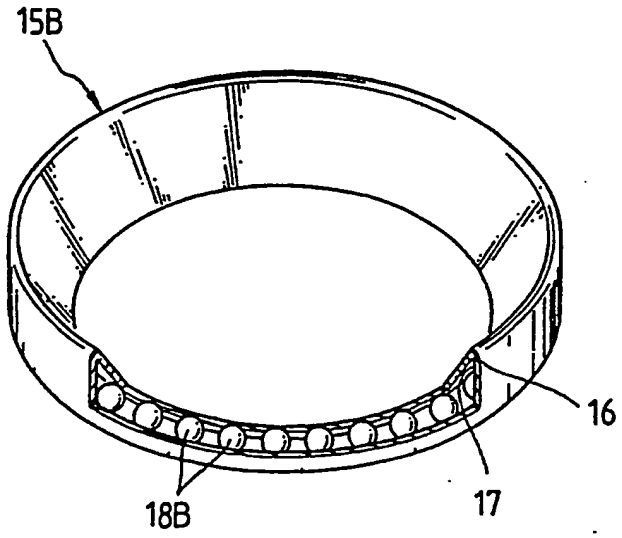


FIG.8

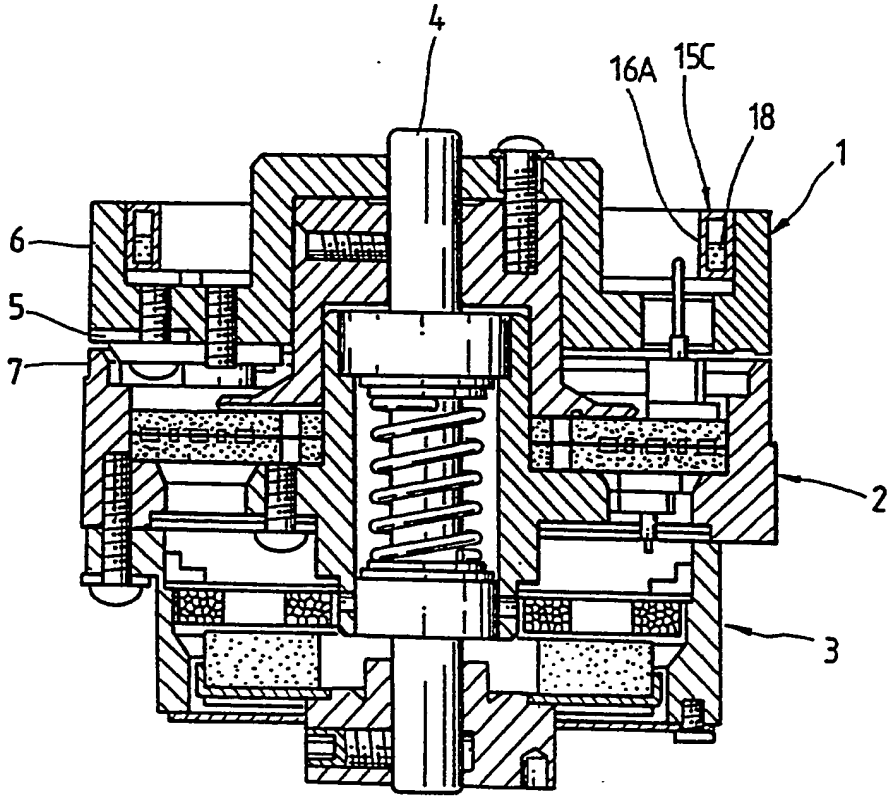
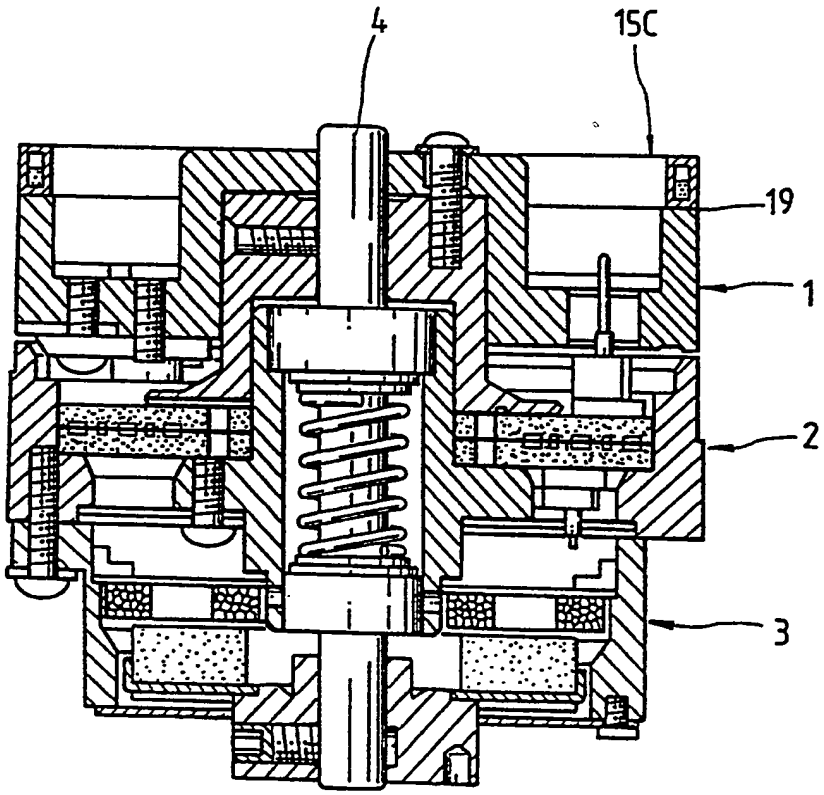


FIG.9



ROTARY HEAD DRUM ASSEMBLY

The present invention relates to a rotary head drum assembly which rotates the record/reproduction transducer for transducing the information of magnetic or optical tapes at high speed and has a balancer for automatically correcting unbalanced rotation of the rotary head drum.

A record/reproduction transducer includes a magnetic head for converting the electrical signal into magnetic signal or vice versa, and an optical head for converting the electrical signal into optical signal or vice versa, and so on. A rotary head drum assembly rotates the transducer at high speed and is installed, for example, in video cassette tape recorder (VCR), digital audio tape recorder (DATR), or camcorder and the like.

As shown in FIG.1 of the accompanying drawings, the rotary head drum assembly consists of an upper rotary drum 1, a lower fixed drum 2 and a drum motor 3. The center of upper rotary drum 1 is integrally coupled with a shaft 4 which penetrates lower fixed drum 2 so as to be connected to drum motor 3. Shaft 4 rotates together with upper rotary drum 1 by means of drum motor 3. A transducer 5 is provided in the lower portion of a circumferencial surface 6 of upper rotary drum 1, thereby to rotate together with upper rotary drum 1. As shown in FIG.2 of the accompanying drawings, a bush member 8 is integrally coupled between upper rotary drum 1 and shaft 4. A disk type

upper rotary core 9 which is attached to bush member 8 so as to rotate together and a disk type lower fixed core 10 which is fixed to lower fixed drum 2, face each other. Coil elements 11 and 12 are respectively provided to the upper rotary core 9 and lower fixed core 10. Here, coil element 11 of upper rotary core 9 is connected to transducer 5, while coil element 12 of lower fixed core 10 is connected to an external circuit device which is not shown. However, transducer 5 and coil element 11 of upper rotary core 9 cannot be directly connected to each other due to structural conditions in assembly, but are connected outside via a circuit board 13 attached to the upper surface of upper rotary drum 1.

In the above-described rotary head drum assembly, tape T is wound on circumferencial surfaces 6 and 7 of upper rotary drum 1 and lower fixed drum 2 to contact transducer 5, as upper rotary drum 1 is rotated at regular speed by means of drum motor 3, tape T is transported, thereby to perform the function of recording/reproducing information on/from tape T. At this time, when upper rotary drum 1 vibrates due to eccentric rotation caused by an unbalance, a relative speed deviation with respect to tape T is generated, which causes a time axis error in the record or reproduction signal, i.e., jitter phenomenon. The jitter phenomenon greatly lowers the performance with respect to the screen and/or sound qualities in analog mode, while causing an error of misreading the recorded data in digital mode.

Accordingly, the rotary head drum assembly should be cautiously

designed and assembled for balanced rotation of all the rotating parts thereof. However, it is very hard to design, process and dispose all the rotating parts such as upper rotary drum 1, transducer 5, upper rotary core 9 and circuit board 13, while holding balance with respect to shaft 4 at the same time. Moreover in fact, it is impossible perfectly to accord the central axis of the total mass where all the mass of the rotary parts are summed to the geometric central axis, i.e., the center of the shaft 4, due to the irregularity of the weight and assembly difference of each of the parts. Therefore, the high level-balance adjustment under practical drive conditions is needed in the rotary head drum assembly after the assembly process is completed.

In the conventional method for adjusting the balance, as shown in FIG. 3 of the accompanying drawings, a suitable amount of solder 14 for adjusting the balance has been located at predetermined locations of circuit board 13 attached to the upper surface of upper rotary drum 1. However, the problem is that inefficiency is caused by repeating the same balance adjusting procedure since the amount of solder 14 for adjusting balance and the attachment location thereof cannot be correctly adjusted at one time, and an error to some extent remains, which prevents the perfect balance adjustment.

It is an object of the present invention to provide a rotary head drum assembly having a balancer which does not require precise balance adjustment and has an automatic balance adjustment function in rotation.

It is another object of the present invention to provide a rotary head

drum assembly having a balancer for preventing the jitter phenomenon caused by the unbalanced rotation of a rotary head drum which rotates the record/reproduction transducer.

According to the present invention there is provided a rotary head drum assembly having a transducer for transducing the information of a tape medium, comprising:

an upper rotary drum provided with the transducer at the circumference thereof and a shaft at the center thereof to be rotated together with the transducer in accordance with the rotation of the shaft;

a lower fixed drum for supporting the shaft of the upper rotary drum; and

balancing means for automatically correcting the unbalanced rotation of the upper drum caused by the mass eccentricity upon rotation.

In preferred embodiments the balancing means which automatically adjust the unbalanced rotation comprises a ring type liquid or ball balancer disposed around the shaft of the upper rotary drum so as to rotate with the upper rotary drum and has a structure in which a "fluid" e.g. a liquid and/or a plurality of spheres is confined in a hollow ring so that the "fluid" can move along the circumference of the hollow ring. That is, when the center of mass of all the rotary parts including the upper rotary drum leans with respect to the rotary axis, the center of mass of the "fluid" moves so as to accord with the center of the rotary axis according to the degree of eccentricity in

rotation. The movement contributes to the whole balance rotation. The automatic balance adjustment function of the balancer will be described in detail later.

Embodiments of the present invention will now be described, by way of example, with reference to the accompanying drawings, in which:

FIG.1 is a perspective view showing the conventional rotary head drum assembly;

FIG.2 is a side sectional view showing the internal structure of the rotary head drum assembly shown in FIG.1;

FIG.3 is a plan view for explaining the conventional balanced rotary head drum assembly;

FIG.4 is a perspective diagram showing the rotary head drum assembly having a liquid balancer according to an embodiment of the present invention;

FIG.5 is a side sectional view of a rotary head drum assembly having a liquid balancer according to the embodiment shown in FIG.4;

FIG.6 is a plan view for explaining the automatic balancing function of the balancer of the rotary head drum assembly according to an embodiment of the present invention;

FIG.7A is a partially cutaway perspective view of a liquid balancer of an embodiment of a rotary head drum assembly of the present invention;

FIG.7B is a partially cutaway perspective view of a ball balancer used of an embodiment of a rotary head drum assembly of the present invention;

FIG.8 is a side sectional view of another embodiment of a rotary head drum assembly provided with a balancer having another structure; and

FIG.9 is a side sectional view of a further embodiment of a rotary head drum assembly provided with another form of balancer.

As shown in FIG.4, a rotary head drum assembly having a balancer according to an embodiment of the present invention comprises upper rotary drum 1, lower fixed drum 2, drum motor 3 and balancer 15. As in the conventional assembly, shaft 4 is integratedly coupled with the center of upper rotary drum 1. Shaft 4 extends through lower fixed drum 2 and is connected to drum motor 3. Shaft 4 rotates together with upper rotary drum 1 by means of drum motor 3. Transducer 5 is provided in the lower portion of a circumferencial surface 6 of upper rotary drum 1, thereby to rotate together with upper rotary drum 1. As shown in FIG.5, bush member 8 is integratedly coupled between upper rotary drum 1 and shaft 4. A disk type upper rotary core 9 is attached to bush member 8 so as to rotate together and a disk type lower fixed core 10 fixed to the lower fixed drum 2 are provided to face each other. Coil elements 11 and 12 are respectively provided to upper rotary core 9 and lower fixed core 10. Here, coil element 11 of upper rotary core 9 is connected via a circuit board 13 attached to the upper surface of upper rotary drum 1, while coil element 12 of lower fixed core 10 is directly connected to an external circuit device which is not shown.

Balancer 15 is fixed on circuit board 13 of the upper surface of upper

rotary drum 1 so that the balancer 15 and upper rotary drum 1 can rotate together. The section of balancer 15 is a right angled triangle. Balancer 15 consists of a hollow ring 16 having an annular hollow space 17 located in the predetermined circumference around shaft 4, and a fluid 18 confined in the hollow space 17. Here, fluid 18 can move circumferentially within the hollow space 17. An automatic balancing function of balancer 15 is explained with reference to FIG.6 below.

Assume a state in which upper rotary drum 1 rotates under the condition wherein the center (a_2) of total mass of all the rotating parts belonging to upper rotary drum 1 leans towards the outside with respect to the geometric center (a_1) of shaft 4. In such state, the centrifugal forces F_1 and F_2 respectively from geometrical center (a_1) and the center (a_2) affect on the point P of the fluid 18 of balancer 15. As a result, the resultant force F_3 of centrifugal forces F_1 and F_2 acts on point P of fluid 18. F_3 consists of component F_{31} of the normal line direction and component F_{32} of the tangential line direction. Accordingly, fluid 18 at point P moves by component F_{32} of the tangential line direction. Thus, the movable fluid 18 of balancer 15 moves to a direction opposing the eccentricity location of the center (a_2) of mass, thereby to correct the deviation of the center (a_2) of mass. Accordingly, a rotary head drum assembly having such a balancer rotates in an automatically balanced state when the predetermined time passes after the rotation.

As shown in FIGs.7A and 7B, the above-described balancer 15 can be either a liquid balancer 15A having liquid 18A or a ball balancer 15B containing a plurality of spheres 18B, depending on the "fluid" 18 used. Here, liquid 18A has mass, and a liquid having a low viscosity like water or a solution of salt is desirable. In addition, as shown in FIG.8, a balancer 15C can be provided having a hollow ring 16A with a quadrilateral section. Balancer 15C can be attached on upper portion 19 of the edge of upper rotary drum 1, as shown in FIG.9. Even though not shown in detail, a mixture of liquid 18A and a plurality of spheres 18B can be used as the fluid.

As described above, the rotary head drum assembly having a balancer according to the present invention can be automatically balanced. Thus, additional balancing for balanced rotation of a rotary head drum which rotates the record/reproduction transducer at high speed is not needed, thereby simplifying the design and assembly. Further, the signal noise and operation error caused by a jitter phenomenon can be prevented, which contributes to the quality improvement.

CLAIMS:

1. A rotary head drum assembly having a transducer for transducing the information of a tape medium, comprising:

an upper rotary drum provided with said transducer and a shaft which rotates together with said transducer in accordance with the rotation of said shaft;

a lower fixed drum for supporting the shaft of said upper rotary drum; and

balancing means for automatically correcting unbalanced rotation of said upper drum caused by mass eccentricity upon rotation.

2. A rotary head drum assembly according to claim 1, wherein said balancing means comprises:

a hollow ring having a hollow therein along the circumference thereof which is located about the shaft of said upper rotary drum; and

a movable material confined within said hollow.

3. A rotary head drum assembly according to claim 2, wherein said movable material comprises a liquid.

4. A rotary head drum assembly according to claim 2 or 3, wherein said movable material comprises a plurality of spheres.

5. A rotary head drum substantially as herein described with reference to Figures 4 to 6 with or without reference to any of Figures 7A, 7B, 8 and/or 9 of the accompanying drawings.

Patents Act 1977 Examiner's report to the Comptroller under Section 17 (The Search report)	Application number GB 9326321.8
Relevant Technical Fields (i) UK Cl (Ed.M) G5R (RB25, RB84, RNK, RKN, RKY, RLX, RML, RMD) (ii) Int Cl (Ed.5) G11B (5/52, 5/53, 7/12, 15/61)	Search Examiner M J DIXON Date of completion of Search 31 JANUARY 1994
Databases (see below) (i) UK Patent Office collections of GB, EP, WO and US patent specifications. (ii) WPI ONLINE	Documents considered relevant following a search in respect of Claims :- ALL

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